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4.11 Test of Dry-out of a Partially Saturated Medium

This test verifies that FEHM has correctly implemented the heat- and mass-transfer problem that combines water, water vapor, air, and heat transport. Figure 47 shows that the dry-out front computed using FEHM agrees closely with the analytical solution (results found in files *dryout.analyt2–6*) presented in Chapter III for systems with and without vapor-pressure lowering. The region of dried-out rock proceeds as a sharp front with little spreading, and the rate of movement predicted by the code agrees well with the analytical solution. The maximum percent errors in the positions of the front (the position at which the saturation is 0.1, or dried to 50% of its initial value of 0.2) are 1.3% for both the vapor-pressure lowering case and the case without vapor-pressure lowering (Table 53). Both of these errors are less than 5%, and thus these results meet the acceptance criteria for this test suite developed in Chapter III.

Table 53. Results of the test of dry-out of a partially saturated medium

V&V test	Maximum error	Maximum % error	RMS error
Dryout front versus time w/o vapor-pressure lowering			
Time 100 days	0.6392e-04	0.2623	0.1311e-02
Time 200 days	0.2675e-03	0.5489	0.2744e-02
Time 300 days	0.6338e-03	0.8669	0.4334e-02
Time 400 days	0.1076e-02	1.104	0.5518e-02
Time 500 days	0.1585e-02	1.301	0.6504e-02
Dryout front versus time with vapor-pressure lowering			
Time 200 days	0.3110e-03	1.276	0.6380e-02
Time 400 days	0.2973e-03	0.6099	0.3050e-02
Time 600 days	0.8632e-04	0.1181	0.5903e-03
Time 800 days	0.2393e-03	0.2454	0.1227e-02
Time 1000 days	0.6580e-03	0.5399	0.2700e-02

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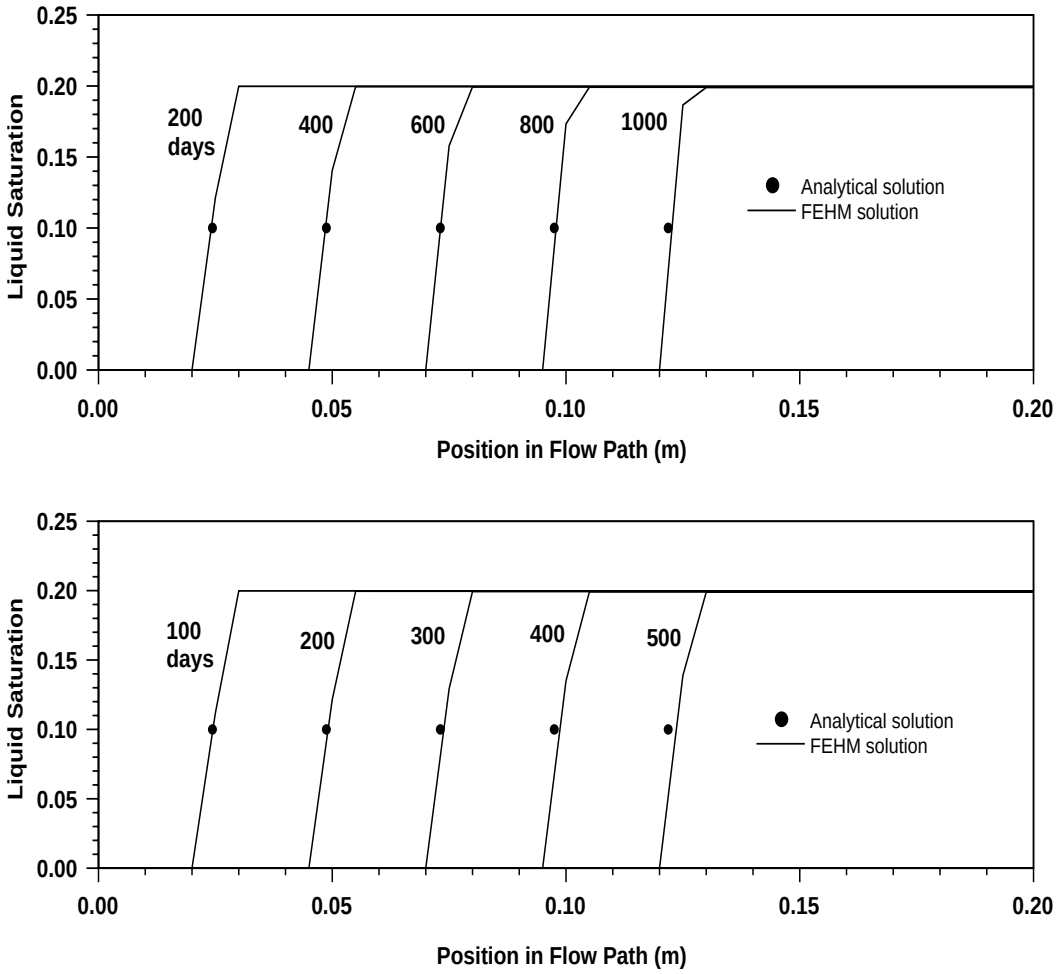

Figure 47. Comparison of FEHM and analytical solutions for the position of a dry-out front in a partially saturated medium. Cases with (top) and without (bottom) the effects of vapor-pressure lowering are included.